

UNCLASSIFIED
Security Classification

DOCUMENT CONTROL DATA - R & D		
(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)		
1. ORIGINATING ACTIVITY (Corporate author) U.S. Army Test and Evaluation Command Aberdeen Proving Ground, Maryland 21005		2a. REPORT SECURITY CLASSIFICATION UNCLASSIFIED
		2b. GROUP -----
3. REPORT TITLE U.S. Army Test and Evaluation Command Materiel Test Procedure Commodity Engineering Test Procedure "Rescue Equipment, Personnel Aircraft Crash"		
4. DESCRIPTIVE NOTES (Type of report and inclusive dates) Final		
5. AUTHOR(S) (First name, middle initial, last name) -----		
6. REPORT DATE 10 May 1971	7a. TOTAL NO. OF PAGES 41	7b. NO. OF REFS 28
8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S) MTP 7-2-090	
b. PROJECT NO. AMCR 310-6	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report) -----	
c.		
d.		
10. DISTRIBUTION STATEMENT Distribution of this document is unlimited.		
11. SUPPLEMENTARY NOTES -----	12. SPONSORING MILITARY ACTIVITY Headquarters U.S. Army Test and Evaluation Command Aberdeen Proving Ground, Maryland 21005	
13. ABSTRACT This procedure defines methods for evaluating equipment utilized for rescue operations of aircraft crash, including clothing and tools.		

DD FORM 1473

REPLACES DD FORM 1473, 1 JAN 64, WHICH IS
OBSOLETE FOR ARMY USE.

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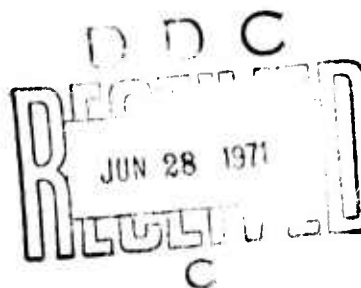
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10 May 1971

Materiel Test Procedure 7-2-090
General Equipment Test Activity

U.S. ARMY TEST AND EVALUATION COMMAND
COMMODITY ENGINEERING TEST PROCEDURE

RESCUE EQUIPMENT, PERSONNEL AIRCRAFT CRASH



AD 725541

1.

OBJECTIVE*

This document provides test methodology and testing techniques to determine the technical performance and safety characteristics of aircraft crash rescue equipment and associated tools and equipment as described in Materiel Need (MN), and Technical Characteristics (TC), and to determine the items suitability for service tests.

2.

BACKGROUND

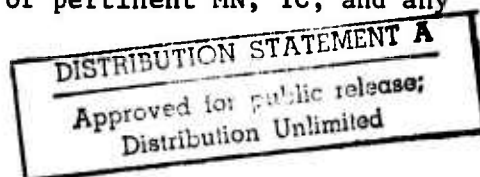
Army aviation crash rescue operations are primarily undertaken to recover personnel trapped or incapacitated by injury from fixed or rotary-wing aircraft damaged during take-off or landing operations at or near airfields or heliports. When considering the requirements for Army crash rescue equipments, the longer range, yet equally important, search and rescue missions must be included. These operations are usually for locating, assisting, and recovering personnel stranded in rugged, uninhabited, or hostile areas as as result of an aircraft crash or forced landing.

The majority of aircraft crashes are caused by personnel errors, materiel failures, and direct or indirect enemy actions. Regardless of the cause or causes, the most serious and immediate hazard to flight and rescue personnel following an aircraft crash is the risk of fire. The danger of fire is always present in normal day to day aircraft operations because of the flammable and fire-accelerating materials required for sustaining flight, providing life supporting services for flight personnel, and carrying out specific military missions. Principally, the flammable and fire accelerating materials include fuel, oxygen, oils, hydraulic fluid, anti-icing fluid, grease, pyrotechnics, ammunition, and other types of aircraft ordnance.

In a given crash situation the hazard from fire may be increased by fuel lines, fuel tanks, control valves, or pumps throughout the aircraft structure becoming twisted, ruptured, or punctured by impact forces, thus allowing flammable vapors or fluids to escape. The escaping vapors or

*This MTP is intended to be used as a basic guide in preparing actual test plans for the subject equipment. Specific criteria and test procedures must be determined only after careful appraisal of pertinent MN, TC, and any other applicable documents.

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10 May 1971

fluids may be ignited by contact with overheated metal surfaces, exhaust gases, broken and arcing electrical wiring or connections, or the discharge of static electricity. The resulting fire can ignite other materials which possess higher flash or ignition threshold temperatures. As this sequence occurs, the intensity of the existing fire is increased and this leads to structural penetration and possible rupture of other flammable materials, storage tanks, etc. In addition to the direct hazard of the flames, flight personnel, trapped or incapacitated by injury, may be subjected to toxic products resulting from the high temperature decomposition of aircraft materials. Spilled and burning fuel in the crash vicinity may prevent flight personnel from escaping and could thwart rescue personnel from approaching the crew and passenger compartments.

The foregoing discussion has addressed the principal hazard associated with aircraft crashes. This hazard is present at all aircraft crash situations whether near to or remotely located from centers of rescue facilities, equipment, and personnel. It becomes obvious, then, that the Army and others must continually strive to develop and test complete systems, techniques, and equipments which can reduce the time to reach the damaged aircraft and to more effectively remove or assist personnel from immediate danger.

Improved rescue techniques and equipment are also required for the situations where an aircraft is reported overdue or there are other indications that a crash or forced landing has occurred. In these cases, the rescue commodities and equipment are to be used by forces dispatched to search for, rescue, or provide material aid to the survivors until such time as they can be removed to safety.

Equipment and rescue systems likely to be required in the future can be divided into major categories for both of the rescue situations previously described.

These are --

- 1) Systems, equipment, clothing, devices, tools, and supplies used by the rescuer in direct contact with the disabled aircraft or those operated/used in the immediate vicinity of the crash to remove or assist personnel in escaping from disabled and burning aircraft.

- 2) Emergency supplies, signaling equipment, personnel, and tools parachuted, airdropped, or lowered by hoist to assist personnel stranded as a result of an aircraft crash.

Testing of commodities procured for the foregoing purposes must take into consideration a wide range of environmental conditions and operational stresses representative of various emergency situations and field conditions under which specified performance must be achieved so crash victims can be saved and rescue personnel not be unnecessarily exposed to hazards.

10 May 1971

3. REQUIRED EQUIPMENT

3.1 GENERAL EQUIPMENT

- a. Steel rule, 0-18 inches.
- b. Tape measure, 0-6 feet.
- c. Photographic equipment.
- d. Weighing scales, 0-100 pounds.
- e. Weighing scales, 0-200 grams.
- f. POL substances, JP-4, gasoline, etc.
- g. Temperature measuring devices.

3.2 TEST JIGS AND TESTING MACHINES

- a. Rockwell hardness tester, 0-120 Brinell and 0 Rockwell C.
- b. Tensile testing machine, 0-60,000 psi.
- c. Torsion test mandrels equivalent to existing aircraft fasteners.
- d. Torsional moment test apparatus.
- e. Bending moment test mandrels.
- f. Bending moment test apparatus.
- g. Impact testing machine.
- h. Shear testing machine.
- i. Automatic cycling machine for unique test item endurance test requirements.
- j. Hydrostatic testing equipment and fixtures.

3.3 TEST FACILITIES

- a. Physical property determination laboratory.
- b. Chemical analysis laboratory.
- c. Corrosion testing facility.
- d. Sand and dust test facility.
- e. POL burn site.
- f. High temperature chamber.
- g. Fungus test facility.
- h. Radiant energy testing facility.

4. REFERENCES

- A. Army Regulation 70-38 Research and Development: Research, Development, Test, and Evaluation of Materiel for Extreme Conditions of Environment.
- B. AMC Pamphlet AMCP 706-134 Engineering Design Handbook: Maintainability Guide for Design.
- C. USATECOM Regulation 70-23 Research and Development: Equipment Performance Reports (EPRs).
- D. USATECOM Regulation 385-6 Safety: Verification of Safety of Materiel During Testing.

- E. USATECOM Regulation 700-1 Quality Assurance: Value Engineering.
- F. USATECOM Regulation 750-15 Maintenance of Supplies and Equipment: Maintenance Evaluation During Testing.
- G. USAGETA Document Human Factors Evaluation Data for General Equipment (HEDGE).
- H. FED-STD-151 Metals; Test Methods.
- I. FED-STD-601 Rubber; Sampling and Testing.
- J. FED-STD-751 Stitches, Seams, and Stitchings.
- K. FED-SPEC CCC-T-191 Textile Test Methods.
- L. FED-SPEC DDD -L-20 Label; for Clothing, Equipage, and Tentage.
- M. MIL-STD-129 Marking for Shipment and Storage.
- N. MIL-STD-130 Identification Marking of US Military Property.
- O. MIL-STD-810 Environmental Test Methods.
- P. MIL-E-5272 Environmental Testing Associated Equipment, General Specification for.
- Q. MTP 7-2-095 Survival Equipment (Aviation).
- R. MTP 7-2-506 Safety.
- S. MTP 10-2-051 Fire Extinguishers.
- T. MTP 10-2-500 Physical Characteristics.
- U. MTP 10-2-501 Operator Training and Familiarization.
- V. MTP 10-2-503 Transportability.
- W. MTP 10-2-505 Human Factors Evaluation.
- X. MTP 10-2-507 Maintenance Evaluation.
- Y. MTP 10-2-511 Quality Assurance.
- Z. MTP 10-2-512 Reliability.
- AA. TM 700-8400-1 Fitting of Uniforms.
- AB. MIL-STD 1472A Human Engineering Design Criteria for Military Systems, Equipment, and Facilities.

SCOPE

SUMMARY

This procedure describes the preparation for and methods of evaluating the technical performance and safety characteristics of aircraft crash rescue equipment. The degree of conformance with required standards and established criteria may be determined by subjecting the rescue equipment to the following evaluations.

a. Preparation for Test - A determination of the rescue equipment condition upon receipt and the procedures by which the equipment size, weight, capacity, volume, and material composition parameters are measured and recorded. Also, provisions are provided to ensure that the equipment is complete, functionally operational, and that appropriate personnel are trained and familiarized with the operation, servicing, and maintenance of the equipment.

b. Performance Characteristics Tests - A series of subtests performed to determine in quantitative terms the performance characteristics of protective clothing, rescue tools and implements, fire fighting and arresting apparatus, and rescue systems.

c. Environmental Tests - A series of subtests developed to reveal the equipment performance characteristics when subjected to controlled environmental stresses representative of the conditions of intended use.

d. Durability - An evaluation of the equipment inherent capability to retain original physical and performance characteristics following periods of prolonged operation.

e. Transportability - An evaluation of the equipment, the shipping container, and packaging to withstand the stress of normal handling and transporting by specified media.

f. Maintenance and Reliability Evaluation - Evaluations to determine and appraise the maintenance characteristics and requirements of the equipment; to verify and appraise malfunctions and to evaluate the equipment associated publications, common and special support elements of the maintenance test package; to appraise the equipment design for maintainability¹; to evaluate component and system reliability, and to compute the indicators which express the effects of the preceding aspects.

g. Safety - An evaluation of the equipment safety characteristics and to determine any hazards associated with its use.

h. Human Factors - An evaluation to determine the adequacy of the design and performance characteristics of the rescue equipment and associated equipment in terms of conformance to accepted human factors engineering design criteria.

i. Value Analysis - An evaluation of the equipment primary function and features with respect to reducing its cost without compromising performance, reliability, quality, maintainability, or safety.

j. Quality Assurance - An evaluation of the rescue equipment with the objective of appraising the quality of workmanship and the degree of material freedom from defects and flaws.

6. PROCEDURES

6.1 PREPARATION FOR TEST

¹ Refer to appropriate sections of AMCP 706-134 relating to accessibility, ease of maintenance, standardization, and interchangeability.

NOTE: An EPR should be prepared in accordance with USATECOM Regulation 70-23 whenever the equipment is discovered to be incomplete, damaged, or deviates from established performance standards or essential criteria requirements.

6.1.1 Initial Inspection

a. Inspect shipping containers for evidence of damage. Photograph damage noted, as appropriate.

b. Examine container markings for compliance with appropriate requirements of MIL-STD-129 or other governing documents. Record container markings which identify contents and indicate quantity. Photograph any special markings which caution handlers or denote special handling.

c. Unpack the equipment using the instructions furnished. Inventory the contents against the Basic Issue Item List (BIIL) if furnished, or the external markings of the container identifying contents.

d. Determine condition of the equipment for test as demonstrated by freedom of the equipment from damage or defect.

6.1.2 Physical Characteristics

Subject the equipment to the dimensional, physical specification, and material characteristics tests of MTP 10-2-500. Ensure that all classes of rescue equipment are adequately defined in terms of their physical characteristics by carrying out the measurements prescribed by the following paragraphs, as applicable.

a. Protective Clothing

- 1) Perform the following measurements and record the results.
 - a) Breast - Measure across the breast area, from side seam to side seam, at the bottom of the armholes.
 - b) Sleeve length - Measure along the sleeve inseam, from the base of the armhole to the bottom of the cuff.
 - c) Leg inseam length - Measure along the leg inseam, from the center of the crotch to the bottom of the leg.
- 2) Match the test item fabric/material with a sample of approved/desired shade under natural (north sky) or artificial daylight having a color temperature of 7500 degrees Kelvin. Record whether or not the desired color match was achieved.

- 3) Identify test item stitches, seams, and stitchings, by classification, in accordance with the criteria of FED-STD-751.
 - 4) Determine from appropriate test item material samples the physical properties of each textile test item type listed below according to the indicated method(s) of CCC-T-191.
 - a) Weight, Method 5100.
 - b) Breaking strength, Method 5100.
 - c) Tear strength, Method 5134.
 - d) Bursting strength, Method 5122.
 - e) Resistance to water, Method 5512.
 - f) Thickness, Method 5030.
 - 5) Determine from appropriate test item material samples the physical properties listed below for each elastomer test item (or test item component) according to the indicated methods of Federal Test Method Standard No. 601.
 - a) Elongation, Method 4121.
 - b) Tensile strength, 500% elongation, Method 4111.
 - c) Tensile strength at break, Method 4111.
 - d) Hardness, Method 3021.
- b. Rescue Tools
- 1) "V" Blade Rescue Knives
 - a) Width of stock.
 - b) Length overall.
 - c) Width of cutting edge.
 - d) Angle at cutting edge.
 - e) Thickness of cutting edge (nominal).
 - f) Length of taper (nominal)
 - 2) Hammers
 - a) Weight.
 - b) Handle length.
 - c) Head description, e.g., circular, etc.
 - d) Head surface, e.g., slightly convex, etc.
 - 3) Screwdrivers
 - a) Length of blade.
 - b) Width of blade.
 - c) Thickness of blade.
 - d) Length of handle.
 - e) Length of tang in handle.
 - f) Other shape characteristics.
 - 4) Wrenches (Open End)
 - a) Width of milled openings, head(s).
 - b) Length, overall.
 - c) Thickness of head (maximum).
 - d) Weight.
 - e) Offset angle (if any).

- 5) Wrenches (Box)
 - a) Wrench opening, small end.
 - b) Wrench opening, large end.
 - c) Outside diameter of head, small end.
 - d) Outside diameter of head, large end.
 - e) Thickness of head(s).
 - f) Overall length.
- 6) Conduct a chemical analysis of the material(s) used for the manufacture of nonsparking type aviation rescue tools. Record the chemical composition, including:
 - a) Beryllium
 - b) Cobalt
 - c) Silicon
 - d) Nickel
 - e) Aluminum
 - f) Tin
 - g) Lead
 - h) Zinc
 - i) Chromium
 - j) Copper

NOTE: Nonsparking rescue tools are generally made of copper and aluminum alloys which present a low sparking hazard for use in fuel spill areas where flammable gases are present.

c. Fire Fighting or Arresting Apparatus

- 1) Fire Hose Assemblies
 - a) Weight.
 - b) Length (use Federal Test Method Standard No. 601, Method No. 2411).
 - c) Extension of nipple beyond end of hose.
 - d) Threads on external fitting mating portions of hose couplings.
 - e) Maximum restriction in inside diameter of hose due to deformation caused by the attachment of the hose fitting. (Unless otherwise specified, a steel ball having a diameter of $0.063 + 0.00, -0.001$ inch less than the nominal inside diameter of the hose shall pass under its own weight through the entire hose length and the attached fittings.)
- 2) Fire Extinguishers
 - a) Overall weight.
 - b) Overall length.
 - c) Overall diameter.
 - d) Diameter of inlet pipe.
 - e) Diameter of outlet pipe.

10 May 1971

- f) Diameter of pressure gauge connection.
- g) Magnetic permeability (including attachments and aircraft mounting brackets, as appropriate).
- h) Chemical composition of agent(s) utilized.
- 3) Fire Extinguishing or Arresting Systems
 - a) Weight of each major component.
 - b) Dimensions of each major component.
 - c) Overall weight and dimensions.
 - d) Capacity of tankage, bins, etc., under standard temperature and pressure.
 - e) Chemical composition of agent(s) utilized.

d. Emergency Supplies

Consult paragraph 6.1.5, Physical Characteristics, of MTP 7-2-095, Survival Equipment (Aviation).

6.1.3

Operator Training and Familiarization

Instruct and familiarize test personnel with appropriate aspects of the rescue equipment and the principals upon which the equipment is designed. Consult MTP 10-2-501 for guidance in planning the training program; ensure that the following elements have been considered.

a. Personnel selection - Personnel selected for the test team should possess the basic qualifications necessary to carry out assigned tasks relative to rescue equipment evaluations. Personnel having prior experience with the operation, maintenance, servicing, or testing of similar equipment should be assigned whenever possible.

b. Training program - The training program should include lecture material reviewing the physical principals underlying each type of equipment scheduled for test. Test methodology should be related to these principals and to the basic criteria specifying individual design requirements and the range of conditions under which performance standards are demanded.

c. Aircraft familiarization - Team members should be familiarized with the types of construction, materials, and hazardous items commonly carried aboard Army aircraft.

d. Requirements documents - Test personnel should be familiarized with MN requirements, engineering test objectives, and the plan of the test.

e. Test apparatus - The various test set-ups should be used during this period and test team members should demonstrate adequate proficiency with their use before beginning testing for the record.

MTP 7-2-090
10 May 1971

6.1.4 Required Equipment, Facilities and Personnel

Arrange for the items listed under paragraph 3, Required Equipment, and for special consultants, e.g., aeromedical specialists, etc., or other personnel required during any of the scheduled engineering tests.

6.1.5 Inspection and Preliminary Operation

6.1.5.1 Protective Clothing

a. Perform preliminary fitting, sizing, and inspections in accordance with the draft technical manual.

b. Ensure that the clothing is clean and is not stained or otherwise soiled. Also, check metal fastenings for evidence of corrosive effects.

c. Examine test item label(s) or patches for conformance with MIL-STD-130, DDD-L-20, or other governing documents. Record evidence of the following:

- 1) Size information incomplete, incorrect, or illegible.
- 2) Label misplaced or missing altogether.
- 3) Other defects or incomplete information furnished.
- 4) Special cleaning requirements not clearly marked.

6.1.5.2 Rescue Tools and Systems

a. Perform preliminary operations, inspections, and adjustment in accordance with the draft technical manual.

b. Inspect, examine, and determine the extent to which the tools or systems conform to the standards and criteria of pre-engineering tests.

c. Scribe straight lines centrally along both sides of rescue tools handles, blades, body, etc., continuing across jaws, openings, etc. so that permanent set of the tool can be detected following application of compression, tension, torsion, bending, and/or shear forces. Proceed as follows:

- 1) Hold the test item securely in a definite position on a vertical face plate attached to a horizontal face plate.
- 2) Use a surface gauge to scribe straight lines on the tool.
- 3) Measure the jaw openings of any open-ended type tool and record these dimensions for each predetermined reference point.

6.1.5.3 Fire Extinguishers

a. Subject the fire extinguisher to appropriate hydrostatic strength tests from those listed below:

- 1) Extinguisher shell.
- 2) Shell cap, test bonnet or fitting.
- 3) Refillable gas cartridge or cylinder.
- 4) Valves, e.g., discharge, flood, etc.
- 5) Pressure relief devices.
- 6) Pressure regulator.
- 7) Discharge nozzle and delivery hose.

b. Ensure that the extinguisher pressure gauge is accurately calibrated.

6.1.6 Medical Examinations

Where personnel are required to participate in the conduct of tests in an active manner, e.g., wear the protective clothing, use the equipment, etc., the test team members should undergo physical examinations. The following information should be determined and recorded on a medical data form to be maintained for each participant.

- a. Physical fitness.
- b. Presence of any dermatological condition.

6.2. TEST CONDUCT

- NOTES:
1. All equipment malfunctions occurring throughout the conduct of the tests shall be reported in accordance with USATECOM Regulation 70-23.
 2. Project officer review of appropriate safety consideration prior to initiation of testing is required. (See paragraph 6.2.6, Safety.)

6.2.1 Performance Characteristics

6.2.1.1 Protective Clothing

Determine the essential characteristics of special clothing used to protect individuals when fighting high temperature fires common to aircraft crashes.

6.2.1.1.1 Sizing and Fitting Test -

- a. Process the total number of participating test subjects

MTP 7-2-090
10 May 1971

through a sizing procedure. Measure and record the following data for each test subject:

- 1) Height.
- 2) Weight.
- 3) Chest dimension.
- 4) Arm dimension.
- 5) Hip dimension.
- 6) Inseam.
- 7) Shoulder (width and depth).

- NOTES: 1. Techniques and procedures for obtaining the measurements required above may be found in TM 700-8400-1.
2. Personnel selected as test subjects for this test should, in an overall manner, reflect the statistical distribution of the group for which the clothing is intended or the 5th, 50th, and 95th percentile, as applicable.

b. Using the data collected in step a. and the sizing information available on the test item, predict a garment size for each test subject. Issue the size predicted. Record, prior to test item donning, the size prediction for each test subject.

c. Instruct test subjects to don their respective protective garments.

d. Following step c., a qualified inspector should examine each test subject and rate the quality of apparent fit as good, fair, or poor. Where poor fit ratings were given, subsequent fittings should be made until a good or fair fit is obtained. Record in tabular form the results of this step.

e. Photograph each test subject during or following the conduct of step d. In each case, the best fit obtainable should be photographed and the record marked to show good, fair, or poor fit.

6.2.1.1.2 Donning and Removing Test -

a. Using the information obtained from test subject measurements of 6.2.1.1.1 step a. and following a successful fit, (also see 6.2.1.1.1 steps c. and d.), instruct test participants to don and remove the test item(s) a minimum of three times each over appropriate liners and/or undergarments. Assign test subjects in pairs; perform donning by the "buddy" system, i.e., mutual assistance in getting into the protective clothing.

- 1) Donning sequence:
 - a) Remove outer garments.
 - b) Don appropriate or recommended under garments.

MTP 7-2-090
10 May 1971

- c) Don socks of the recommended type.
- d) Don appropriate bunker coats and trousers with and without inner liners, as appropriate.
- e) With a "buddy" to assist, don the aluminized body cover and adjust the reflective folds to the configuration recommended.
- f) Don the reflective gloves and boots with assistance, as required.
- g) Don the protective hood with facepiece and drape fabric.
- 2) Removing sequence: Reverse the donning sequence.

b. Record the following data for each test subject:

- 1) Time required to don the test item.
- 2) Time required to remove the test item.
- 3) Assistance required, human or material.
- 4) Difficulties encountered.

c. Interview (or issue questionnaires to) each participant. Record the opinion of these persons in regard to the ease of donning and removing the protective clothing. In particular, quiz each test participant (test subjects, fitters, observers, and inspectors) on the following; phrasing the questions to obtain direct, specific answers.

- 1) Suitability of test item fastenings and adjustments.
- 2) Ability to effect fastenings and adjustments.
- 3) Apparent difficulties observed by qualified observer/recorder.
- 4) Ease of donning and removing the test item over clothing, other garments, and/or equipment.

6.2.1.1.3 Controlled Environment Dynamic Performance Test -

Determine the overall performance characteristics of the protective clothing to reflect or otherwise protect potential wearers from the intense heat of POL type aircraft fires. Proceed as follows:

- a. Establish a wind-free test facility area in which aircraft crash POL type fires may be safely initiated.
- b. Obtain two identical manikins. Instrument each for temperature at the neck, face, wrist, back, leg(s) and ankles.
- c. Clothe one manikin with the protective clothing currently under evaluation and the other with the in-service protective clothing or other control clothing as appropriate.
- d. Set-up the manikins in the fire facility of a. above and instrument area to measure fire envelope temperature.

e. Arrange a series of POL fires containing:

- 1) Mixtures in the proper proportion of JP-4 and oil, hydraulic fluids, and other flammable materials carried on each type of Army turbine aircraft.
- 2) Mixtures in the proper proportions of gasoline, oil, hydraulic fluids, and other flammable materials carried by each type of conventional aircraft.

f. Schedule for each of the above types of fires, one which simulates a crash during take-off, e.g., the maximum amount of POL material metered to represent each aircraft maximum capacity.

g. Schedule for each of the fires of subparagraph e., one which simulates a crash during landing, e.g., adjusting the proportions of flammable fluids appropriately for consumptions typical of the Army aircraft.

h. When all segments of the controlled fire testing have been completed, cut samples from each protective ensemble (test and control). Subject these samples to a chemical analysis including microscopic examination of the fibers, to determine the degree of change due to exposure to the various POL fires.

i. Record observed testing parameters during the test, including such informations as:

- 1) Location of temperature sensors.
- 2) POL substances used in each fire and quantity of each.
- 3) The temperature signatures of each test fire.
- 4) Manikin temperature sensor readings for each fire.
- 5) Description of the cleaning process used to ready the protective clothing for each fire test.

NOTE: This evaluation should be preceded by the protective clothing portion of the Durability Test, paragraph 6.2.3.

6.2.1.2 Rescue Tools

6.2.1.2.1 Torsion Test for Heavy Rescue Hand Tools -

a. Set-up mandrels containing slots representative of the aircraft fasteners, ejection seat fittings, etc., likely to be encountered in rescue operations. The following considerations are important in the selection and use of the mandrels for this test:

- 1) The mandrels should possess slots equivalent to existing aircraft structural screws, machine screws, self-tapping screws, and internal wrenching bolts.
- 2) The size of the mandrel opening should be equal to the specified tool size within a minus tolerance of 0.001 inch, or as otherwise specified. A plus tolerance should not be permitted.
- 3) The mandrels used should be hardened to show a Rockwell hardness number of C40 to C46, or as otherwise specified.
- 4) The depth of the internal mandrel slot(s) should be no greater than the thickness of the end of the tool blade plus the tolerance permitted.

b. Prepare the test item for the test according to
6.1.5.2 c. as applicable.

c. Insert the test item blade into the mandrel slot, supporting the tool so that it is perpendicular to the plane of the top surface of the mandrel. Also, constrain the tool to prevent the blade from leaving the mandrel slot when the torsional moment is applied.

d. Attach an arm, bar, or clamp to the tool near the middle of the natural grip of the handle such that the torsional force will be applied substantially at right angles to the axis of the tool.

e. Apply the specified force through a spring balance near the end of the arm, bar, or clamp which was attached during step d. The force is applied at right angles to the axis of the tool and is applied in right-and left-hand directions alternately. Compute the torsional moment by multiplying the force, in pounds for example, by the arm, in inches for example, e.g., fifteen-pound load applied 10 inches from axis of the tool is equal to 150 inch-pounds, etc. Record the force applied, the direction, i.e., left-hand, right-hand, and the total number of applications.

f. Following application of the torsional moment(s), examine the tool and record evidence of the following:

- 1) Blade or tool arm failure.
- 2) Permanent set due to torsional forces.

6.2.1.2.2 Bending Test for Heavy Rescue Hand Tools -

a. Set up mandrels for test item openings which are representative of the types and classifications of aviation fastener or other objects for which the tool is intended for use. The following considerations are important in the selection and use of the mandrels for this test:

- 1) The mandrels should be square, hexagonal, or shaped equivalent to existing aviation fasteners.
- 2) The size of the mandrel should be equal to the specified tool opening size within a plus tolerance of 0.001 inch, or as otherwise specified. A minus tolerance should not be permitted.
- 3) The mandrels used should be hardened to show a Rockwell hardness number of C40 to C46, or as otherwise specified.

NOTE: Mandrels for tools with adjustable openings should be sized for the mid-point opening value and maximum tool opening.

b. Prepare the tool for test according to 6.1.5.2 c., as applicable.

c. Attach the tool to the appropriate mandrel such that the plane of the tool is perpendicular to local vertical.

NOTE: Unlike actual usage of the tool, the mandrel represents only a suitable device for fitting the test item opening so that the tool is properly supported and a realistic reaction against the bending moment load is provided.

d. Apply the specified bending moment load to the tool at the center of the natural hand grip on the handle, or as far away from the tool opening as practicable.

NOTE: The bending moment load may be applied by an appropriate testing machine or by recently calibrated dead weights.

e. Continue the application of the bending moment load for not less than one minute or more than five minutes, unless otherwise specified. Record the force applied, i.e., total dead weight applied and the length of time the load was applied.

f. Measure and record the effective lever arm through which the bending moment load acts.

NOTE: The length of the effective lever arm is defined as the shortest distance between two vertical lines passing, respectively, through the point of load application and the center of the mandrel fitting the tool opening.

g. Repeat steps d., e., and f. for specified overload values. Record data required by these steps.

h. After application of the testing load(s), place the tool on the gauge jig (6.1.5.2.c.). Compare the scribed marks on the test tool to the scribed marks on the jig. Any permanent deformation of the tool will be indicated by a change in the alignment of these scribed marks made prior to application of the bending moment forces. Record evidence of permanent deformation.

i. Measure open ended test item openings and compare to original dimensions. Record evidence of spreading tool jaws or enlargement of openings resulting from the effects of the application of the bending moment force(s).

6.2.1.2.3

Impact Test -

a. Prepare the tool for test in accordance with 6.1.5.2 c.

b. Clamp the tool in a testing machine such that the test item working surface is at right angles to the impact test force or weight.

c. Subject the tool to repeated blows of the testing machine drop weight or hammer. Record the magnitude of force (weight) used and number of blows performed.

d. Following the application of impact forces, subject the tool to an examination. Record evidence of the following:

- 1) Chips, cracks, or other damage to the tool working surface.
- 2) Distortion of the working surface as indicated by misplaced scribed lines.

6.2.1.2.4

Shear Test -

a. Prepare the tool for test in accordance with 6.1.5.2 c.

NOTE: This test is applicable to pliers and all forms of aviation rescue cable, bolt, etc., cutters.

b. Introduce the tool into the testing machine such that shear stress is exerted on those test item parts normally under shear in use. Record the method of set-up and identify the component which was stressed, i.e., the pin which connects together a pair of pliers, etc.

c. Apply shear stress as specified. Record the value of force used and duration of the test.

d. Following application of shear stress, examine the tool and record evidence of the following:

- 1) Damage to connecting pins, etc.
- 2) Pliers, etc., sides loosened by application of force.
- 3) Side cutters, etc., which do not perform as specified following application of shear force.

6.2.1.3 Fire Extinguishers and Arresting Systems

a. Complete preliminary inspections and pretests in accordance with paragraph 6.1.5.3, Fire Extinguishers.

b. Determine the engineering performance characteristics of fire extinguisher(s) in accordance with appropriate evaluations of MTP 10-2-051, Fire Extinguishers, Paragraph 6.2.7, Performance Tests.

6.2.1.3.1 Dynamic Controlled Environment Performance Test, Fire Extinguishers -

a. Utilize the controlled fire facility specified under paragraph 6.2.1.1.3 a., and instrument the area for accurately measuring the signature of POL type fires.

b. Combine POL substances equivalent to the proportions carried on Army aircraft. Record the quantities involved.

c. Set POL fires, monitor temperature with recording devices, and using recommended techniques, attempt to extinguish the blaze with the test extinguisher and agent. Record length of time fire burned prior to extinguishing attempt, the fire temperature signatures, the length of time required to control adequately or extinguish the blaze using the test extinguisher and agent.

d. Repeat step c. for various combinations of POL, e.g., JP-4, gasoline, etc. Use alternate extinguishing agents and vary the length of time before initiating the extinguishing agent(s) to simulate various delays in reaching the simulated crash.

6.2.1.3.2 Dynamic Controlled Environment Performance Test, Aircraft Systems-

Carry out the evaluations for these aircraft mounted fire extinguishing or arresting systems.

6.2.2 Environmental and Climatic Simulation Evaluations

Subject the rescue equipment to the environmental and climatic conditions specified by the paragraphs of this evaluation description. Determine the capability of the test item(s) to resist physical damage and/or deterioration when subjected to accelerated climatic and environmental stresses. The various environmental test standards should be employed only to the extent specified by the applicable governing document, e.g., the MN, etc. General guidance for the climatic tests can be obtained through AR 70-38; other appropriate standards are referenced, where applicable.

6.2.2.1 Protective Clothing

6.2.2.1.1 High Temperature Exposure (Tackiness) -

a. Obtain two samples from the test item approximately two inches by two inches in size.

b. Sandwich the samples together between two glass plates of a slightly larger size.

c. Subject the combination of step b. to a pressure of $0.25 \pm .01$ pound per square inch.

d. Obtain a thermostatically controlled oven of a size suitable for containing the clamped test item samples and glass plates.

e. Subject the test item samples to two hours at 170 degrees F. in the test oven. Record actual values.

f. Following the time heating period, remove the test item samples and cool in a conditioned atmosphere.

g. After five minutes, the samples should show no evidence of adhesion or exudation when separated. Record the results of this step and other details, as applicable.

6.2.2.1.2 Fungus Resistance Test

Subject the test item to the 28-day fungus resistance test in accordance with Method 508.1, Procedure I of MIL-STD-810. At the end of the test, examine the test item visually, and record evidence of deterioration or other effects.

MTP 7-2-090

10 May 1971

6.2.2.1.3 Solar Furnace Test -

Subject test item samples to the 48-hour radiant energy test in accordance with Procedure I of MIL-E-5272. At the end of the test, test item parts should be examined visually and evidence of deterioration or other effects recorded.

6.2.2.2 Rescue Tools and Metal Rescue Equipment and Components

6.2.2.2.1 Salt Spray Test -

Determine the ability of the test item to resist corrosion when subjected to a fine mist of 5 percent sodium chloride solution at a temperature of 95 degrees F. This test is applicable for test item assemblies, metallic coatings, organic and inorganic coatings on metals, and many non-metallic materials. Perform in accordance with Method 811.1 of Federal Test Method Standard No. 151. Record details of test conduct and the effect of the exposure on the test item.

6.2.2.2.2 Synthetic Sea-Water Spray Test -

Determine the ability of the test item to resist corrosion when subjected to a fine mist of synthetic sea water at a temperature of 75 degrees F. This test is applicable to rescue equipments made of steel which is subject to localized pitting attack. Perform in accordance with Method 812 of Federal Test Method Standard No. 151.

6.2.2.2.3 Intergranular-Corrosion Test for Corrosion Resistant Austenitic Steels -

Determine test item ability to resist corrosion when subjected to an acidified copper-sulfate solution following a sensitized, descaling, and immersion procedure. This test is applicable to rescue tools made of stabilized extra-low-carbon, and annealed unstabilized steel. Perform in accordance with Method 821.1 of Federal Test Method Standard No. 151.

6.2.2.2.4 Intergranular-Corrosion Test for Aluminum Alloys -

Determine the susceptibility of aluminium alloy test items to intergranular corrosion. Perform according to Method 822 of Federal Test Method Standard No. 151.

6.2.2.2.5 Mercurous-Nitrate Test for Copper Alloys -

Determine the susceptibility of copper alloy test items (such as non-sparking tools) to fail in use or storage due to stress-corrosion cracking. Perform according to Method 831 of Federal Test Method Standard No. 151.

6.2.2.2.6 Sand and Dust Test

Perform the sand and dust test, Method 410 of MIL-STD-810,

and record all test results. At the completion of the sand and dust test, examine and inspect each test item type for the effects of sand and dust, including the following:

- a. Abrasion to test item moving parts.
- b. Test item coatings damaged.
- c. Test item parts which were caused to bind by sand or

dust.

6.2.2.3 Rescue Systems (Such as Helicopter Winches, etc.)

6.2.2.3.1 Operating Temperature Range -

Perform the following:

a. Place the winch or other rescue equipment on a suitable test stand in an environmental chamber at a sufficient height to allow for a load test, as appropriate.

b. Raise the temperature to +120°F. and allow the test item to set for (4) hours.

c. Operate the test item at rated load, raising and lowering the load through several cycles.

d. Operate all controls, adjustments, gear ratios, etc. to determine any malfunctions.

e. Lower the temperature to -25°F. and allow the test item to stand for (4) hours.

f. Repeat procedures c. and d.

6.2.2.3.2 Storage Temperature Tests -

Perform the following:

a. Using the test set-up of paragraph 6.2.2.3.1 a., subject the test item to the following:

- 1) A high temperature of +155°F. for not less than (4) hours.
- 2) A low temperature of -65°F. for not less than (12) hours.

b. Remove the test item from the chamber; allow time for the item to assume ambient temperature and subject to a complete operational check.

c. Record any evidence of damage.

6.2.3 Durability

6.2.3.1 Mechanical Equipment

a. Set-up the test item in a normal operating configuration under standard ambient environmental conditions. Record actual values.

MTP 7-2-090
10 May 1971

b. Obtain the necessary fixtures so that the test item may be automatically operated through a large number of cycles where repeatable conditions of force, etc., are obtainable during each cycle. Record the method of obtaining controlled durability testing of each component or equipment.

c. Instrument the test item and apparatus, where applicable, to obtain the following data:

- 1) Speed of rotation.
- 2) Temperature at the working surface, as applicable.
- 3) Operating cycles.
- 4) Decreasing efficiency.
- 5) Loss of accuracy.
- 6) Test item failure.

d. Following the durability test, repeat the applicable portion of paragraph 6.2.1, Performance Characteristics. Record any change in test item performance.

6.2.3.2 Protective Clothing

a. Clean the test item no less than fifty times in accordance with the procedures of the draft technical manual or other furnished instructions. Record a description of each cleaning process used.

b. Use the test item for training, for testing, and other realistic applications of the clothing. Bring in contact with various POL substances, if applicable. Subject the clothing to numerous exposures to aircraft hulks containing metal fragments, jagged metal, and other realistic hazards to rescue clothing. Record applications.

c. Following the exposure described in subparagraph b. above, and the cleaning processes of subparagraph a., examine the test item and record the following:

- 1) Evidence of cuts and tears in the reflective fabrics.
- 2) Presence of any residues of fuels, extinguishing agents, oils, chemicals, dirt, etc.
- 3) Any other damage or change which any component of the clothing has undergone due to usage and cleaning.

6.2.4 Transportability

Evaluate the transportability characteristics of the rescue equipment in accordance with the procedures of MTP 10-2-503.

a. Consult MIL-STD-129 for guidance concerning proper marking of the equipment for shipment.

b. Carry out the procedures of the draft technical manual and package/pack the equipment for the transport type(s) used.

c. Unpack and inspect the equipment following completion of each mode of transportation. Where no defects can be observed, operationally verify that no internal damage or degradation of performance has occurred. Record results of these operations and inspections.

6.2.5 Maintenance and Reliability

6.2.5.1 Protective Clothing

Determine the maintenance or "up-keep" characteristics of the rescue protective clothing under test as follows:

a. Use test items rejected during the extended use and clothing durability tests (6.2.3.2) because of seam failures, rips, and/or other minor fabric problems.

b. Use repair kits furnished with the test item or repair materials authorized for use. Repair the test item. Record the following:

- 1) Adequacy of supplied repair instructions in draft technical manual.
- 2) Adequacy of repair kits.
- 3) Ease with which test item is repaired, if applicable.

c. Consider and use as appropriate, information obtained during Durability Test, paragraph 6.2.3.2, for determination of engineering judgments regarding ease of overall test item maintenance or up-keep.

6.2.5.2 Maintenance - Equipment and Systems

a. Evaluate and appraise the maintenance/reliability - related factors of the test item as described in MTP 10-2-507, MTP 10-2-512 and USATECOM Regulation 750-15 with emphasis on the following:

- 1) Organizational (O), Direct Support (F), and General Support (H) maintenance requirements.
- 2) Operator through General Support Maintenance Literature.
- 3) Repair parts.
- 4) Tools.
- 5) Test and handling equipment.
- 6) Calibration and maintenance facilities.

MTP 7-2-090
10 May 1971

- 7) Personnel skill requirements.
- 8) Maintainability.
- 9) Reliability.
- 10) Availability

b. Obtain the data required by Appendix B of USATECOM Regulation 750-15.

6.2.6 Safety

Evaluate the safety characteristics and determine any hazards associated with the design of the rescue equipment. Consult MTP 7-2-506.

- NOTES:
1. Provide a safety recommendation in accordance with USATECOM Regulation 385-6, and the test directive, as applicable.
 2. During the conduct of all tests, test personnel shall observe the proper safety precautions and, in particular, shall adhere closely to the draft technical manual for the handling and use of the test item.
 3. The procedures for all tests shall be examined and any which might constitute a safety hazard shall be recorded and also reported to the testing officer.

a. Examine the safety characteristics of the test item inherent to its design. Evaluate provided safety provisions with respect to the implicitly hazardous rescue requirements. Rate the test item as safe, marginal, critical, and potentially unsafe when subjected to known rescue situations.

b. Prepare a list of test item safety provisions and indicate what the purpose of each is and whether or not the approach is adequate.

c. During the conduct of all evaluations of the engineering test, record the incidence of any material failure or application procedure which appeared to endanger the user or be potentially hazardous to personnel being rescued.

d. List the contents of warning or other safety instructions. Note the location of each and evaluate the effectiveness of that position and the presentation of the warning or safety instruction.

6.2.7 Human Factors Evaluation

Consult the applicable procedures of MTP 10-2-505 and include considerations found in the following paragraphs during evaluation of the rescue equipment.

a. HEDGE applicability:

- 1) Protective Clothing - Use design criteria specified by HEDGE for Class IV C materiel.
- 2) Rescue Tools - Normally, the HEDGE classification of III B is appropriate for the evaluation criteria of maintenance and repair tools of all types. However, rescue tools will be used many times under conditions of extreme stress and should, therefore, be considered from that viewpoint.
- 3) Rescue Systems - When the system involved is monitored only during operation, the HEDGE Classification II B is appropriate. Manually operated rescue systems should be evaluated against criteria of HEDGE Class II A.

b. The prime human factors consideration for the suitability of any one of the rescue equipments, clothing or systems is that the physical and psychological effects of wearing the clothing or using the equipment must not detract from the rescuer's mission or in any indirect way, decrease the probability of mission success.

c. Human factors engineering evaluations shall be conducted simultaneously with all engineering evaluations. The test plan should be laid out to ensure that ample opportunities are provided to evaluate the man-item interface in the following areas:

- 1) Transport.
- 2) Handling.
- 3) Preparation for use.
- 4) Application and employment.

d. Psychological reactions of the rescuer to the equipment or clothing should be monitored and recorded throughout all tests. Test subjects should be medically examined to determine any physical effect(s) on the body that can be related to the equipment use.

6.2.8 Value Analysis

a. Throughout conduct of the engineering test, observe the operation of the test item(s) and record the presence of any feature which appears as if it could be eliminated without:

- 1) Impairing performance.
- 2) Decreasing reliability.
- 3) Detracting from desired quality.
- 4) Complicating maintainability or supportability.
- 5) Decreasing margins of safety.

b. USATECOM Regulation 700-1 shall be used for guidance throughout this evaluation; the areas listed below should be studied in particular;

- 1) Mission Capacity - The test item should be capable of accomplishing the specified task with only a reasonable margin of excess capability. Excess capacity and unused capability can result in unnecessary bulk, excessive weight and unwarranted costs.
- 2) Simplicity - Unnecessarily complex components and systems, redundancy, and the use of unneeded parts can decrease reliability, increase costs, and maintenance efforts.
- 3) State of the Art - In many instances the use of recently developed, currently available, components and automated features will result in an overall product improvement and cost savings.
- 4) Standardization - The use of the identical parts and parts currently in the military system will reduce the overall logistics burden.

6.2.9 Quality Assurance

Throughout all tests, examine the test item for compliance with the quality requirements of the applicable MN or TC and the provisions of MTP 10-2-511.

6.3 TEST DATA

NOTE: In compiling the Test Data section, test personnel should amplify those data procedures which are other than quantitative in nature by recording narrative descriptions. These will provide full details of conditions and/or events occurring during the conduct of the test.

6.3.1 Preparation for Test

6.3.1.1 Initial Inspection

Record the following:

- a. Evidence of damage incurred by the rescue equipment during transport or storage.
- b. Exterior test item identification markings not in accordance with MIL-STD-129 or other governing documents.
- c. Interior test item markings not in accordance with MIL-STD-130 or other governing documents.
- d. Evidence of defects in test item materials and construction, treatment and finish, and/or workmanship.
- e. Inventory check:
 - 1) Evidence of missing literature.
 - 2) Shortages in kit contents.
 - 3) Improper content.

6.3.1.2 Physical Characteristics

Record the data required by the applicable procedures of MTP 10-2-500 and the following:

- a. Protective clothing:
 - 1) Size measurements:
 - a) Chest.
 - b) Sleeve length.
 - c) Leg inseam length.
 - 2) Degree of color match achieved between test item and standard sample of desired color.
 - 3) Identification of stitches, seams, and stitchings by classification in accordance with criteria of MIL-STD-751.
 - 4) Results of textile physical properties tested according to CCC-T-191:
 - a) Weight.
 - b) Breaking strength.
 - c) Tear strength.
 - d) Bursting strength.
 - e) Resistance to water.
 - f) Thickness.
 - 5) Results of elastomer physical properties tested according to Federal Test Method Standard No. 601.
 - a) Elongation.
 - b) Tensile strength, 500% elongation.
 - c) Tensile strength at break.
 - d) Hardness.

b. Rescue Tools

- 1) "V" Blade Rescue Knives
 - a) Width of stock, in inches.
 - b) Length overall, in inches.
 - c) Width of cutting edge, in inches.
 - d) Angle at cutting edge, in degrees.
 - e) Thickness of cutting edge (nominal,) in inches.
 - f) Length of taper (nominal), in inches.
- 2) Hammer Data
 - a) Weight, in ounces.
 - b) Handle length, in inches.
 - c) Head description (circular, etc.).
 - d) Head surface description (slightly convex, etc.).
- 3) Screwdriver Data
 - a) Length of blade, in inches.
 - b) Width of blade, in inches.
 - c) Thickness of blade, in inches.
 - d) Length of handle, in inches.
 - e) Length of tang in handle, in inches.
 - f) Other shape characteristics for designed purpose.
- 4) Wrenches (Open End) Data
 - a) Width of milled openings, heads, in inches.
 - b) Length, overall, in inches.
 - c) Thickness of head (maximum), in inches.
 - d) Weight, in ounces.
 - e) Offset angle (if any).
- 5) Wrenches (Box) Data
 - a) Wrench opening (small end), in inches.
 - b) Wrench opening (large end), in inches.
 - c) Outside diameter of head, small and large ends, in inches.
 - d) Thickness of heads, in inches.
 - e) Overall length, in inches.
- 6) Chemical content and concentration of nonsparking rescue tools.

c. Fire Fighting or Arresting Apparatus

- 1) Fire Hose Assemblies
 - a) Weight, in pounds.
 - b) Length, in inches.
 - c) Length of extension nipple.
 - d) Type of external threads.
 - e) Inside diameter restriction findings.
- 2) Fire Extinguishers
 - a) Overall weight, in pounds.
 - b) Overall length, in inches.
 - c) Overall diameter, in inches.

- d) Diameter of inlet pipe, in inches.
- e) Diameter of outlet pipe, in inches.
- f) Diameter of pressure gauge connection, in inches.
- g) Magnetic permeability.
- h) Chemical composition of agent(s) utilized.
- 3) Fire Extinguishing or Arresting Systems
 - a) Weight of each major component, in pounds.
 - b) Dimensions of each major component, in inches.
 - c) Overall weight and dimensions, in pounds and inches.
 - d) Capacity of tanks, etc., in gallons.
 - e) Chemical composition of agent(s) utilized.

d. Emergency Supplies

Record data required by applicable procedures of MTP

7-2-095.

6.3.1.3

Operator Training and Familiarization

Record the following:

- a. Data required by MTP 10-2-501.
- b. For personnel requiring retraining:
 - 1) Name.
 - 2) Rank.
 - 3) Past experience.
 - 4) Degree of retraining required.
- c. Test director evaluation of test personnel as a team.
- d. For each team member:
 - 1) Rank.
 - 2) Unit.
 - 3) Experience.
 - 4) Previous training.
- e. Adequacy of technical manual(s) for training purposes.

6.3.1.4

Required Equipment, Facilities and Personnel

Record any difficulties experienced in obtaining the necessary test equipment and scheduling required special support personnel.

6.3.1.5

Inspection and Preliminary Operation

MTF 7-2-090
10 May 1971

Record the following:

a. Protective clothing.

- 1) For each test subject:
 - a) Height, in inches.
 - b) Weight, in pounds and ounces.
 - c) Chest dimension, in inches.
 - d) Arm dimensions, in inches.
 - e) Hip dimensions, in inches.
- 2) Condition of the protective clothing.
- 3) Completeness of labels or patches.
 - a) Size information incomplete, incorrect or illegible.
 - b) Misplaced or missing label.
 - c) Other defects.
 - d) Special cleaning requirements not clearly marked.

b. Rescue tools and systems.

The dimensions of any open jawed test item prior to application of any test forces, in inches.

c. Fire extinguishers.

The results of hydrostatic tests

6.3.1.6 Medical Examinations

Record the physical condition of each team member required to wear or actively employ the rescue equipment at any time during the engineering test.

6.3.2 Test Conduct

6.3.2.1 Performance Characteristics

6.3.2.1.1 Protective Clothing -

6.3.2.1.1.1 Sizing and Fitting Test --

Record the following:

- a. For each test subject:
- 1) Height, in inches.
 - 2) Weight, in pounds and ounces.
 - 3) Chest dimension, in inches.
 - 4) Arm dimensions, in inches.
 - 5) Hip dimensions, in inches.

- 6) Inseam, in inches.
- 7) Shoulder, in inches.

- b. The predicted size data for each test subject.
- c. Availability of proper size for each test subject and the quality of fit rated as good, fair, or poor for each fit.
- d. Photographic evidence regarding quality of each test item fit.

6.3.2.1.1.2 Donning and Recovering Test --

Record the following data for each test subject following the donning and removing operations:

- a. Time required to don the test item.
- b. Time required to remove the test item.
- c. Assistance required, human or material.
- d. Difficulties encountered.

6.3.2.1.1.3 Controlled Environment Dynamic Performance Test (Protective Clothing) --

Record the following:

- a. Description of POL burn course.
- b. Electrical description of instrumentation employed to determine temperature of the control fire signatures, the temperatures of various parts of clothed manikins, and time.
- c. Description of each test, including:
 - 1) Quantity of POL substances mixed to simulate typical aircraft load.
 - 2) Burn time before active "rescue" attempted.
 - 3) Temperatures of each manikin body part with respect to time.
 - 4) Length of time required to control fire, if applicable.
 - 5) Environmental and climatic conditions at time of test.
- d. Description of cleaning process used following each type of fire.
- e. Number of fires/tests attempted.

MTP 7-2-090
10 May 1971

Adequacy of cleaning process.

6.3.2.1.2

Rescue Tools -

6.3.2.1.2.1

Torsion Test for Heavy Rescue Hand Tools --

Record the following:

- a. Size and tolerance of each mandrel used.
- b. Hardness number of each mandrel used.
- c. Depth of each mandrel slot.
- d. Highest torsional force test item withstood without damage or change in performance, in inch-pounds.
- e. Number of right and left hand applications of the test force.
- f. Following test:
 - 1) Blade of tool arm failure.
 - 2) Permanent set due to torsional forces.

6.3.2.1.2.2

Bending Test for Heavy Rescue Hand Tools --

Record the following:

- a. Size and tolerance of each mandrel used.
- b. Hardness number of each mandrel used.
- c. Mandrel head configuration, e.g., square, etc.
- d. Highest bending force test item withstood without damage.
- e. Lever arm length, in inches.
- f. Spreading of test item jaws, in inches.

6.3.2.1.2.3

Impact Test --

Record the following:

- a. Number of blows test item withstood without damage.
- b. Magnitude of force (weight) of each blow, in pounds.

c. Observed during inspection following test:

- 1) Chips, cracks, or other damage to test item working surface.
- 2) Distortions of the working surface as indicated by misplaced scribed lines.

6.3.2.1.2.4 Shear Test --

Record the following:

- a. Method of shear test.
- b. Identification of test item part which was stressed (critical to operation).

6.3.2.1.3 Fire Extinguishers and Arresting Systems (Performance Characteristics) -

Record the data required by the appropriate evaluations of MTP 10-2-051, Fire Extinguishers.

6.3.2.1.3.1 Dynamic Controlled Environment Performance Test - Fire Extinguishers --

Record the following:

- a. Description of POL burn area.
- b. Description of temperature sensing measures.
- c. Identification of each agent used.
- d. Quantity of POL substances used for each fire.
- e. Temperature of control fire during test.
- f. Temperature of test fire with respect to time while being extinguished or controlled by extinguisher under test.

6.3.2.1.3.2 Dynamic Controlled Environment Performance Test - Aircraft Systems --

Record the data required by applicable evaluation of MTP 9-2-295.

6.3.2.2 Environmental and Climatic Simulation Evaluations

6.3.2.2.1 Protective Clothing -

MTP 7-2-090
10 May 1971

6.3.2.2.1.1 High Temperature Exposure (Tackiness) --

Record the following:

- a. Temperature at which test item sample was maintained, in degrees F.
- b. Length of time test sample was held at temperature of a. above, in hours.
- c. Length of time in conditioned atmosphere following test period, in minutes.
- d. Following conditioning, evidence of test item adhesion or exudation when separated.

6.3.2.2.1.2 Fungus Resistance Test --

Record the data required by Method 501.8, Procedure I, of MIL-STD-810.

6.3.2.2.1.3 Solar Furnace Test --

Record the data required by Procedure I of MIL-E-5272 and the data resulting from retest according to procedures of 6.1.2, Physical Characteristics.

6.3.2.2.2 Rescue Tools and Metal Rescue Equipment and Components -

6.3.2.2.2.1 Salt Spray Test --

Record data required by Method 811.1 of Federal Test Method Standard No. 151.

6.3.2.2.2.2 Synthetic Sea-Water Spray Test --

Record data required by Method 812 of Federal Test Method Standard No. 151.

6.3.2.2.2.3 Intergranular-Corrosion Test for Corrosion Resistant Austenitic Steels --

Record data required by Method 821.1 of Federal Test Method Standard No. 151.

6.3.2.2.2.4 Intergranular-Corrosion Test for Aluminum Alloys --

Record the data required by Method 822 of Federal Test Method Standard No. 151.

6.3.2.2.2.5 Mercurous-Nitrate Test for Copper Alloys --

Record the data required by Method 831 of Federal Test Method Standard No. 151.

6.3.2.2.2.6 Sand and Dust Test --

Record the following:

a. Data required by applicable procedures of MIL-STD-810, Method 410.

b. Following test and visual inspection:

- 1) Abrasion to test item moving parts.
- 2) Test item coatings damaged.
- 3) Test item parts which were caused to bind by sand and dust.
- 4) Damage to measuring tool scales.

6.3.2.2.3 Rescue Systems (Such as Helicopter Winches, etc.)-

6.3.2.2.3.1 Operating Temperature Range (Rescue Systems)--

Record the following:

- a. Description of chamber and test stand.
- b. Temperature during test, in degrees F. with respect to time.
- c. Schedule of temperature cycle vs. time.
- d. Operating schedule test item performed.

6.3.2.2.3.2 Storage Temperature Tests --

Record the following:

- a. High temperature, in degrees F.
- b. Hours at temperature of a.
- c. Low temperature, in degrees F.
- d. Hours at temperature of b.

6.3.2.3 Durability

MTP 7-2-090
10 May 1971

6.3.2.3.1 Mechanical Equipment -

Record the following:

- a. Conditions under which test item is configured for the durability test.
- b. Identification of test fixtures obtained for test of unique properties of the test item.
- c. The following "kinds" of data (specific requirements will depend upon test item use, and instrumentation required to test useful lifetime):
 - 1) Speed of rotation.
 - 2) Temperature at the working surface.
 - 3) Operating cycles completed/running time.
 - 4) Decreasing efficiency rate.
 - 5) Loss of accuracy.
 - 6) Test item failure data.
- d. Data resulting from retesting.

6.3.2.3.2 Protective Clothing -

Record the following:

- a. Uses and time in each application.
- b. Evidence of cuts and tears in the reflective fabrics.
- c. Presence of fuel, oil, extinguishing agents, etc., residue.
- d. Any other damage noted.

6.3.2.4 Transportability

Record the following:

- a. Data required by MTP 10-2-503.
- b. Modes of transportation used.
- c. Time to prepare for transport for each method.
- d. Time to unpack and prepare for use after each method.
- e. Evidence of damage or successful operation after transporting.

6.3.2.5 Maintenance and Reliability

6.3.2.5.1 Protective Clothing -

Record the following:

- a. Adequacy of supplied repair instructions in draft technical manual.
- b. Adequacy of repair kits, including fabric, patches, cement, etc., and required accessories.
- c. Ease with which test item is repaired, if applicable.
- d. Frequency of failure.

6.3.2.5.2 Maintenance-Equipment and Systems -

Record the data required by applicable procedures of MTP 10-2-512, MTP 10-2-507, and Appendix B of USATECOM Regulation 750-15.

6.3.2.6 Safety

Record the following:

- a. Ranking of test item in regard to construction characteristics, e.g., good, fair, or poor.
- b. Ranking of test item in regard to the presence of design characteristics which would assist in rescue or prevent human injury, as good, fair, or poor.
- c. Presence of any dangerous or unsafe condition which presents a safety hazard.
- d. Adequacy of warning instructions and markings.
- e. Suggestions to improve existing design for safety.

6.3.2.7 Human Factors Evaluation

Record the following:

- a. Data required by applicable procedures of MTP 10-2-505.
- b. Fill out and complete checklists including:
 - 1) General considerations.
 - 2) Individual considerations.

MTP 7-2-090
10 May 1971

c. Feats of mobility including description of body position which caused the wearer discomfort or restricted movement during rescue operations.

d. Recommendations for improvements in man-item effectiveness.

6.3.2.8

Value Analysis

a. List any non-functional, costly, or "nice-to-have" features of the test item.

b. Record comments for each of the topics listed below:

- 1) Mission Capacity
- 2) Simplicity
- 3) State of the Art
- 4) Standardization
- 5) Materials and Methods of Construction
- 6) Clearances

c. When making recommendations for changes in test item features or components, record the following:

- 1) The feature or component under consideration.
- 2) Recommended change(s).
- 3) Reason(s) for recommended change(s).

6.3.2.9

Quality Assurance

Record:

a. Data required by MTP 10-2-511.

b. Comments as to adequacy of construction and workmanship employed.

6.4

DATA REDUCTION AND PRESENTATION

a. Data obtained during the conduct of the engineering tests shall be summarized, tabulated, and displayed in a manner which will facilitate evaluation. Comparison rescue equipment test data will be displayed to facilitate comparison(s) with appropriate test item(s).

b. Physical characteristics test data will be evaluated as required by appropriate specification test methods for comparison with the technical performance characteristics specified by the MN or other governing documentation.

MTP 7-2-090
10 May 1971

c. Photographs, charts, and narrative descriptions of tests will be made available during the evaluation.

d. Recommendations should be provided in regard to the test item(s) suitability and safety for service testing.